

*Invited lecture/Review*

# From Hip Arthrosis to Hip Replacement Surgery – Total Hip Endoprosthesis

Kocjančič Ema <sup>1</sup>, Kocjančič Boštjan<sup>1,3</sup><sup>1</sup> University of Ljubljana, Faculty of Medicine, Ljubljana, Slovenia<sup>2</sup> University Medical Centre, Department of Orthopaedic Surgery, Ljubljana, Slovenia,\*Correspondence: [ema.kocjancic17@gmail.com](mailto:ema.kocjancic17@gmail.com)

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**Abstract:**

Hip arthrosis is a medical condition that is more commonly present in elderly people that is nowadays also becoming a healthcare burden among the younger, active population. Arthrosis is a process during which cartilage, normally present as a protective factor of the hip joint, gradually wears away, becoming frayed and rough. This results in limited protective joint space, which leads to increased friction and rubbing between hip joint components; acetabulum and femoral bone. Due to arthrosis, patients experience daily pain, limited movements and decreased quality of life. Primary treatment of osteoarthritis includes informing patients of the importance of a healthy lifestyle, including physical activity. As non-surgical alternatives to treating osteoarthritis, orthopaedic surgeons may relieve their patients' symptoms with pharmacological interventions (paracetamol and NSAIDs) and in selected cases intraarticular infiltrations. When all this is no longer effective, surgical relief of pain is recommended, including less invasive procedures, such as hip arthroscopy, hip biopsy, or simple core decompression (CD), or the most invasive, but effective hip replacement surgery - total hip arthroplasty (THA). The latter is a procedure during which diseased and necrotic tissue from the hip joint is removed and replaced with artificial materials, the hip endoprosthesis. The aim of this procedure is to reduce pain and improve patient's mobility and quality of life.

**Keywords:** hip osteoarthritis, hip arthrosis, hip endoprosthesis, surgery, quality of life.



## 1. Introduction

Hip arthrosis, also referred to as hip osteoarthritis, is a medical condition commonly present in elderly people. The condition occurs over time, as day-to-day activities gradually cause the protective cartilage of the hip joint to wear away (Swiss Medical Network, 2023). During the process of arthrosis, joint cartilage becomes frayed and rough, becoming virtually useless. Consequently, the hip joint has minimal protective joint space which would otherwise prevent rubbing between the acetabulum (socket part of hip joint) and femoral head (ball part of joint) (Foran, 2021). Friction and rubbing of bones in a joint may also cause bone spurs (irregular bone growths on edges of the bone which cause a change in the bone's shape) (Hopkins Medicine Org, 2023). Arthrosis causes patients to experience pain when engaging in daily activities, limiting them in their everyday lives. This causes patients to seek different types of orthopaedic treatment, in hopes of improving their quality of life.

## 2. Non-surgical treatment options for hip osteoarthritis

Osteoarthritis treatment has been vastly changing over the past decades. This is a result of earlier diagnosis, patient education, and more in-depth knowledge of the biology of tissues involved. Patient education includes teaching patients, as well as their families the importance of managing a healthy lifestyle, regular physical activity, balanced diet and weight loss. All this can help the patient stay mobile, relieve pain, and reduce risk of other medical issues or at least prolong the time they live prior to developing conditions such as arthrosis (Dunkin, 2023). Knowledge of hip joint tissues has been key in developing non-surgical treatments of hip osteoarthritis. These treatments include infiltration of joint with hyaluronic acid (viscosupplementation) or with platelet rich plasma which contains autologous growth factors (Innocenti et al., 2013). Treatment is coupled with pharmacological interventions in the form of paracetamol and non-steroid anti-inflammatory drugs (NSAID). In cases where such treatment is no longer effective, surgical relief of pain is recommended to the patient (Poulsen et al., 2011).

## 3. Surgical treatment options for hip osteoarthritis

Surgical treatments of hip osteoarthritis may be more or less invasive, their main goal being a delay of prosthetic hip replacement surgery. The latter is, despite its effectiveness and patient satisfaction, still considered a very final surgical solution and may be the cause of patient impediments. Less invasive surgical procedures which a surgeon may offer to their patient include hip arthroscopy. Arthroscopy is a general surgical procedure during which a surgeon creates a small incision at the joint area, through which they insert a narrow tube, attached to a fiber/optic video camera. This allows for the surgeon to view the inside of a patient's joint on a monitor (Staff, 2022). Arthroscopies may be performed on virtually any joint in the human body.

Some patients may also seek orthopaedic help due to a condition called avascular necrosis. The latter is a condition where there is necrosis of bone components due to restriction of blood supply. If untreated, avascular necrosis causes osteoarthritis and bone collapse. In such cases, a surgeon may perform hip biopsy or simple core decompression (CD). The procedure is meant to decompress the femoral head in a condition called avascular necrosis (Padmawar & Landge, 2021). It was, for many years, considered highly cost-effective, minimally invasive and had low complication rate in putting off THA. Nowadays, the procedure's results are debated and controversial, and it is considered outdated, as surgeons no longer perform it except in exceptional circumstances (Sadile et al., 2016).

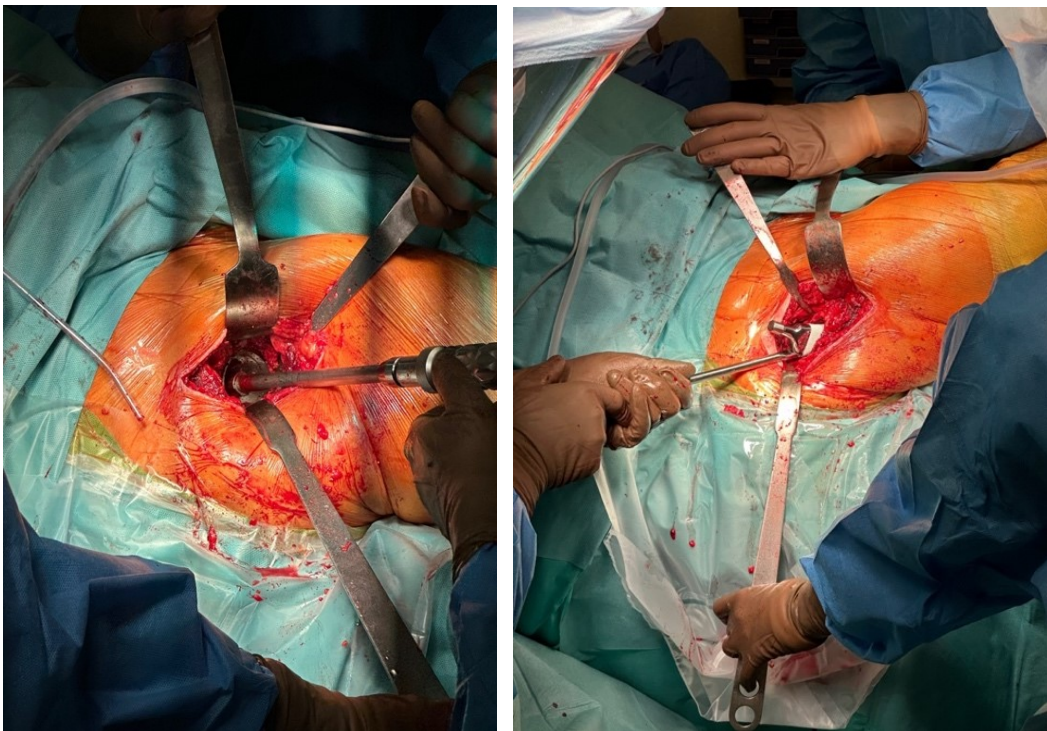
## 4. Hip replacement surgery - total hip arthroplasty (THA)

Undoubtedly more invasive, but also one of the most common and effective orthopaedic surgical treatment methods for osteoarthritis is hip replacement surgery, or total hip arthroplasty (THA) (Varacallo et al., 2017). It is a procedure during which the orthopaedic surgeon removes diseased or necrotic tissue from the hip joint. This tissue includes bone, cartilage and surrounding muscle and fat tissue. The diseased parts of bone include femoral head and acetabulum, which are replaced with artificial materials, prosthesis (**Figure**

1). The aim of THA procedure is to reduce pain and improve patient's mobility and quality of life (Staff, 2022).

The hip endoprosthesis which a surgeon inserts into the patient's joint is made of two separate components: femoral and acetabular. Femoral component is nowadays made of two separate parts – a metallic stem and femoral head. Acetabular component is made of metal acetabular cup and acetabular interface (liner) (Baura, 2021). Endoprosthesis components may be composed of several different materials, each providing its own benefits and restrictions. Femoral stem is nowadays usually fabricated with stainless steel, titanium alloys or cobalt-chromium-molybdenum alloys (Merola & Affatato, 2019).

Cobalt-chromium (CoCr) alloy or aluminium alloy, while in the past the prosthetic component was also made from stainless steel (Baura, 2021). Prosthesis developments have, however, been largely targeted towards the articulating parts of prosthesis, which are the femoral head and acetabular component. In the past, femoral heads were mostly made from CoCr alloy, like the femoral stem, while acetabular cup was metal and its articulating interface either ultra-high molecular weight polyethylene (UHMWPE) (Gibon et al., 2013) or ceramic (Baura, 2021). Components of the hip prosthesis may be made from several different materials, which should be biocompatible and enable long-term survivability of the implant, which is the surgery's main goal (Gibon et al., 2013). Attempts to reduce friction and consequent particle debris formation have caused the metal femoral heads to be replaced with either alumina and zirconia ceramics, as well as oxidized zirconium. Ceramics as prosthetics components have consistently demonstrated reduced friction and consequent longer prosthesis lifespan, but unfortunately it was found that their toughness does not match that of metal. Still, they are the most commonly used materials for femoral heads of hip endoprosthesis today (Salehi and Hunter, 2010).



**Figure 1.** Surgeon reaming acetabular cup (left) and inserting femoral stem component of hip endoprosthesis (right). Source: Author's own archive.

There are three most common approaches for THA procedure (Varacallo et al., 2023). The most common approach for primary and revision cases is posterior approach. It includes blunt dissection of gluteus maximus muscle and sharp incision of fascia lata distally, avoiding hip abductors (Hyland, 2023). This approach is also favourable because of its good exposure of both acetabulum and femur, with the option for elongation of incision proximally or distally. However, some studies have cited higher dislocation rate in posterior approach compared to other surgical approaches (Varacallo et al., 2023).



The second possible THA approach is the direct anterior (DA) approach. The intermuscular interval being used with this approach is between tensor fascia lata and sartorius muscle superficially, and between gluteus medius and rectus femoris deep in the leg. The advantages of approach are the avoidance of hip abductors and reduced dislocation rates following surgery. However, its DA approach's reported disadvantages are increased wound complications, especially in obese patients, who are amongst those more at risk for arthrosis, along with limited femoral exposure and risk of paraesthesia of lateral femoral cutaneous nerve (Varacallo et al., 2023).

The less commonly used THA approach is the anterolateral or Watson-Jones approach. It utilises the intermuscular plane between tensor fascia lata and gluteus medius with a partial or complete detachment of anterior fibres of abductor muscles. In the past few years, incision or detachment of muscles or tendons has been avoided when performing the procedure (Lepri et al., 2020). The anterolateral approach theoretically offers decreased dislocation rate at the cost of postoperative limp (Varacallo et al., 2023).

Following incision and careful retraction of surrounding muscles, femoral neck osteotomy is performed. Usually, a reciprocating saw is used during this step, with the cutting beginning proximally to the lesser trochanter. Osteotomy (bone-cutting process) is continued in a proximal-lateral direction towards the base of the greater trochanter. Following this, surgeon removes surrounding soft tissue (Varacallo et al., 2023). Retractors are placed around the incision to provide acetabular visualization. Before acetabular component is placed, labrum (soft tissue surrounding hip joint) must be removed (Petis et al., 2015). This is done with a scalpel or an electrocautery. Then, acetabulum itself is prepared by reaming, starting with small-size machinery, gradually increasing sized for appropriate medialization of cup. This is demonstrated in Figure 1. Once sclerotic bone is removed and healthy bone is established, prosthetic acetabular component is inserted in a press-fit fashion. Then, corresponding liner is inserted (Varacallo et al., 2023). Then, the femoral canal is prepared for prosthesis insertion. This is done by broaches proximally and by cylindrical reamers distally. Both parts of the femoral endoprosthesis component are then inserted into the femur, which is demonstrated in **Figure 1** (right)(Fye et al., 1998). Prosthesis components may either be "press fit" into the bone, allowing it to grow around prosthesis, or they may be cemented into the bone. The quality and strength of patient's bone is a factor in choosing the right fixation method (Baura, 2021).

##### **5. Hip arthroplasty – an increasing problem in today's aging population**

In the recent years, there has been an increase in the number of both older and younger orthopaedic patients seeking surgical treatment. This might be due to the increasing number of sports injuries, as well as higher life standards and patients wanting to perform everyday activities without limitations. As the incidence of hip osteoarthritis generally increases with age, in today's aging population this is leading to a higher demand for surgical intervention. This presents an increased burden on healthcare resources and hospital budgets (Nemes et al., 2014). Indications for THA have been expanded to include younger patients who are usually more active and recover faster than older patients. Additionally, their postsurgical activity levels and their return to sports are expected to improve, consequently leading to overall higher patient satisfaction post-surgery (Fujita et al., 2022).

As patient satisfaction is an essential indicator in measuring the quality of care, several studies have attempted to measure patient satisfaction immediately and, in the years, following total hip arthroplasty (Varacallo et al., 2018; Okafor and Chen, 2019; Freudenberger et al., 2018). Said procedure is supposed to help with decreasing pain and improving motor function, patient mobility and quality of life. Freudenberger et al (2018) cited almost 60% of THA patients being highly satisfied with their hospital experience (a rating of 9 or 10 out of 10) (Freudenberger et al., 2018). Varacallo et al. (2018) reported 78% of interviewed patients 2-4 years after surgery perceived their replaced hip as "native", and 54% reported uninhibited function of replaced joint (Varacallo et al., 2018). Okafor and Chen (2019) found that older patients may experience greater post-operative, which might be due to their lower expectations of pain relief after having lived with the joint disease for years.



## 5. Conclusion

With today's aging population, hip arthrosis is becoming a major problem that, especially the elderly, are facing every day. Osteoarthritis is also becoming a problem amongst the younger, active population, including professional sportsmen and women. Due to the development of newer, more advanced pharmacological interventions, as well as intraarticular infiltrations, the time which passes before patients can no longer put off hip replacement surgery has been prolonged. However, with the development materials and newer, less invasive approaches to hip replacement surgery, the procedure has become one of the most cost-effective and successful orthopaedic surgeries, with patients being highly satisfied with their reduced pain levels and improved mobility and quality of life post-surgery.

**Conflicts of Interest:** The authors declare no conflict of interest.

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